ENERGOPTIONS

OVERVIEW PAPER

MUNICIPAL SECTOR

Broad Application

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1. INTRODUCTION

In providing services to their residents, municipalities consume large quantities of energy for a variety of purposes. Building heating, cooling and lighting, coupled with vehicle operation, represent significant use areas.

Using energy effectively and eliminating unnecessary waste can provide taxpayers with excellent value for their energy dollar.

This paper provides an overview of a number of measures proven by Canadian municipalities together with documentation of important lessons learned. Suggestions on appropriate next steps and details on resources available are also presented.

2. OPTIONS

With support from the Federal/Provincial Conservation and Renewable Energy Demonstration Agreements (CREDA) Program, a range of options attractive to municipalities were demonstrated. These options include:

- **Low Cost Measures for Buildings**

  - Reduce air infiltration with caulking, sealing and weatherstripping

  - Set temperatures back and turn exhaust fans off when a building is not in use

  - Clean light fixtures and remove unnecessary lighting

- Clean air filters and keep the HVAC system in top running order

- Insulate steam pipes

. **Higher Cost Measures for Buildings**

- Use of computer or microprocessor system to monitor and control energy use

- Reduce electrical demand peaks and control power factor if dollar savings can be realized

- Convert to more efficient lighting sources

- Install heat recovery devices where appropriate

- Increase insulation levels in conjunction with other building renovation and maintenance programs

- Consider heat pumps, including ground and groundwater sourced units or wood residue heating for new buildings where the existing heating system must be replaced

. **Other Options**

- Consider using a central computer to control traffic signals in smaller and medium-sized cities

3. CREDA DEMONSTRATIONS

The ENEROPTIONS case studies outlined below provide a sample of the many options for reducing energy costs and consumption in municipal facilities. Although these projects by no means represent the full range of possible options, they do provide tangible evidence of the very significant cost savings that can be realized by municipalities as well as providing

practical installation and operation experience. The individual Case Studies are contained in this ENEROPTIONS package.

BC 22 Building Energy Management System - Surrey, British Columbia

Energy use in several buildings is monitored and controlled by one central computer which is linked to the individual buildings by way of leased telephone lines. Payback periods as rapid as 1.3 years have been attained.

ONT 54 Computerized Energy Accounting - Ontario

Hudson's Bay Company uses a micro-computer program to monitor monthly energy use in 65 buildings in southern Ontario and to pinpoint inefficient systems and areas of waste. Detailed computer assisted audits of three buildings identified potential energy savings of over $1 million per year. Hudson's Bay found that the better information and increased management effectiveness alone justified the system.

ONT 29 Exterior Insulation Retrofit - Kingston, Ontario

A sixteen-storey residence building, the John Orr Tower, at Queen's University, was retrofitted on the exterior with 3 inches of extruded polystyrene insulation and covered by steel cladding in order to reduce heat loss and rectify a water penetration problem. Annual energy savings were about 28%.

NB 41 University Energy Efficient Retrofit - Mount Allison University, Sackville, New Brunswick

A comprehensive energy management program was initiated at Mount Allison Univeristy including building upgrading, heat recovery, computer control, improved lighting and insulation of steam lines. Comfort levels were greatly improved and annual energy savings were over $157,000 per year.

MAN 39 ENERSCHOOL Retrofit program

Under this major program, 20 schools were retrofitted and a manual was produced to assist school managers in assessing energy consumption and introducing efficiency measures. The twenty schools received complete energy audits. major retrofits were undertaken on two schools and minor retrofits on the remainder. Annual savings at individual schools averaged over $10,000 with average paybacks of under two years.

MAN 40 Remote Computerized Energy Management - Manitoba

Energy consumption in the Minnedosa district school system was monitored and controlled using a computer hooked up to each school. Over 100 Manitoba schools are now in the process of implementing retrofit measures and connecting to remote computers. To date, savings averaging 40% had been realized for both natural gas heated and electrically-heated buildings.

ONT 60 Vertical Loop Ground-Source Heat Pump - Toronto, Ontario

Existing oil-fired boilers in an industrial shop facility were replaced with glycol-to-water heat pumps which extract heat from the ground using a series of vertically-buried loops.

ONT 14 Computer-Controlled Traffic Signals

The central control of traffic signals in three smaller Ontario cities via the use of a small computer. Estimated annual savings range from $300,000 to $2,500,000.

PEI FIRE Heating with Municipal Waste - Charlottetown, P.E.I.

Two hospitals are now heated with energy from Charlottetown municipal waste. The plant, built and operated for five years

under a full service contract by Tricil, saves more than 3 million litres of imported oil per year.

NB 54 Wood Residue Fuelled Boiler - University of New Brunswick-Fredericton, New Brunswick

A large wood-fired boiler was installed, under an innovative financing arrangement, at the district heating plant which serves the entire UNB-Fredericton Campus, two apartment buildings, and a large 485-bed hospital. Annual operating savings in the range of $820,000 are being realized as the contribution to total heating requirements is over 70%.

MAN 43 Two Town Retrofit - Pinawa and Stonewall, Manitoba

To demonstrate the level of conservation implemented after home and building owners are given detailed instrutions, detailed energy audits were performed in more than half the buildings in two Manitoba towns. To encourage participation and a sense of commmunity involvement, an energy conservation competition was staged between the two towns. Combined annual energy savings of 7% to 10% (exclusive of savings in transportation) were demonstrated for the two towns. This added up to a two town annual savings of about $170,000.

Many other energy projects have been undertaken with municipal applications. Contact your nearest federal or provincial energy office to learn more about nearby projects or those in applications similar to yours.

4. LESSONS LEARNED

In the course of installing and monitoring the above demonstration projects, a number of important lessons were learned:

- **Specific Retrofit Measures**

  - The support and commitment of building operational staff is an important key to success. These people can usually offer excellent suggestions on low-cost measures. Later in the program, when higher cost measures are implemented, maximum savings will only be obtained through the dedication of operational staff in keeping the equipment in top running order.

  - Low-cost measures can generally be implemented by operational staff and local contractors without extensive studies. Experience shows that these measures are cost-effective and funding can generally come from operating budgets.

  - Every facility is unique and the services of a qualified in-house energy auditor or experienced consultant is required to identify the appropriate package of higher cost measures for any particular building.

  - Encourage the building operational and maintenance staff to work closely with the energy auditor during the study phase. Their familiarity with the facility and their suggestions are usually very valuable. Their commitment to the measures that are eventually installed is often critical.

  - It is important for the energy auditor to give consideration to the quality and capabilities of the operational staff when recommending particular approaches. There is little to be gained by installing technologies that cannot be operated or maintained properly.

- The application of exterior cladding insulation to an existing building is only cost-effective if performed in conjunction with an architectural retrofit of the building. This measure, like the installation of extra roof insulation, generally cannot be justified on the basis of energy savings alone.

- When undertaking energy improvements, a building must be treated as an integrated system. If a significant sealing or insulation program is undertaken, modifications to the HVAC system will also likely be required to insure indoor air quality and comfort.

- Heat pumps can provide much higher efficiencies than other approaches. Their use should be investigated for new buildings or in buildings where the existing heating system must be replaced.

. **Automated Systems**

- A comprehensive functional systems specification, (i.e., what a system is required to do, not specific equipment) is strongly recommended for all such systems (be they building controls or traffic signal controls). The quality of this specification will have an important bearing on the success of the project. It may be cost-effective for several departments in larger centres or several smaller communities to pool their resources and prepare a joint specification for a larger package of hardware and software.

- Consider having one party take overall responsibility for the entire system. To operate successfully, all hardware, software and communications links must be compatible. While several parties are involved, incompatibility problems can arise and areas of responsibility may be unclear.

- Consider using a two-stage tendering process. In the first stage, potential suppliers are invited to submit unpriced technical proposals in response to the functional specification. These proposals can be reviewed, clarifications can be obtained and the

functional specification can be refined to ensure that all bids are directly comparable on a functional basis. In the second stage, a smaller group of qualified bidders can be invited to submit refined, priced proposals.

If a single-stage bidding process is used, the technical quality of the proposals may differ widely and the low-priced bid may not represent the best overall value.

- The installation of computer or microprocessor based controls will provide an exciting challenge to some operational staff while others will view it as a threat and possibly even an adversary to be defeated.

  Skillful employee management is required to ensure:

  . Staff receive the required training

  . More than one person can program, operate and maintain the system

  . Action is taken with staff members who are not adjusting to the new technology

- Automated systems are most cost-effective (e.g., one year paybacks can be obtained) in buildings with heavy yet highly variable use patterns. They are likely not cost-effective for buildings with continuous and consistent use patterns.

- Where capital cost of the system is a barrier, consider a savings financing arrangement whereby an outside party finances the costs and is repaid out of the facility's savings over a period of time. Such arrangements can also include operation and maintenance of the equipment.

5. RESOURCES AVAILABLE

Free technical reports are available on most of the CREDA projects listed above. Addresses of appropriate contacts for follow-up, including equipment suppliers and system designers, are listed at the end of each of the attached ENEROPTIONS Case Studies under the "Further Information" section.

The departments or ministries of energy in each province or territory have information on energy conservation and renewable energy and may have assistance programs. Check your telephone directory for appropriate contacts.

The Conservation and Renewable Energy Offices (CREOs) of Energy, Mines and Resources Canada in each province and territory have information on demonstrations, and other assistance programs. Check the back of the attached file folder for the office in your area.

Information on qualified engineering firms by area of specialization and the "Recommended Procedure for the Selection of an Engineer to Provide Professional Services", can be obtained from:

(a) The Association of Consulting Engineers of Canada
(Re: ENEROPTIONS)
Suite 616
130 Albert Street
Ottawa, Ontario
K1P 5G4
(613) 236-0569

(b) The consulting engineering organization in your province.

Information on innovative financing arrangements may be obtained through the government sources listed above, or by contacting:

Martin Adelaar
(Re: ENEROPTIONS)
Energy Management Advisor
Energy Conservation and Oil Substitution Branch
Energy, Mines and Resources Canada
580 Booth Street
Ottawa, Ontario
K1A 0E4
(613) 995-1118